## REMARKS

Claims 1-28 were pending in the application. Claims 1-4, 6-11, 13-18, 20-25, 27 and 28 were rejected. Claims 5, 12, 19 and 26 were objected to. Claims 1, 5-8, 12, 15, 19, 21-22, 26, and 28 were amended. Claims 29-35 were added. Claims 1-35 remain in the application.

Applicants would like to thank the Examiner for graciously supplying a copy of a missing page of the Office Action.

A typographical error was corrected in Claim 15.

Claims are discussed in the same order as in the Office Action.

Claims 8, 13, and 14 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,642,433 by Lee et al. ("Lee"). Claims 8, 13, and 14 also stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 3,737,855 by Cutaia. The rejection stated in relation to Lee:

> 'Regarding claim 8, Lee discloses a method (figure 3) of determining overall lightness contrast of an image comprising:
>
> '1) extracting pixel values from said image (column 3, lines 66+: the central computer digitizes the microscope image to extract pixel values);
>
> '2) calculating an image edge contrast based on said pixel values (16, figure 3: the "edges of edges" computation is a measure of contrast at the edges);
>
> '3) calculating area contrast based on said pixel values (12, figure 3: morphological operations are used to calculate the contrast ("edge intensity") of the entire image area, as represented by the edge gradient); and
>
> 'B) calculating said overall lightness contrast of said image by combining: said edge contrast, said area contrast and (column 5, line 61 through column 6, line 7: the image contrast score is defined as the ratio of the accumulated edges of edges intensity ("image edge contrast") and the accumulated edge intensity ("area contrast")).'

and stated in relation to Cutaia:

> 'Regarding claim 8, Cutaia discloses a method (figure 3) of determining overall lightness contrast of an image comprising:

'1) extracting pixel values from said image (photodetector 8 extracts pixel values);

'3) calculating area contrast based on said pixel values (column 10, line 30: BJK is a calculation of the area contrast within the area LA);

'4) calculating an image range based on said pixel values (column 10, lines 30: the dimensions L and A are calculated as an image range); and

'B) calculating said overall lightness contrast of said image by combining: said image range and said area contrast and (column 10, lines 69-70: BJK(normalized) represents an overall contrast measure and is calculated as a combination of the image range LA and the area contrast BJK).'

Claim 8 has been amended to state:

8. A method of determining overall lightness contrast of an image comprising:

A) extracting pixel values from said image;

B) performing at least one of the following processes:

1) calculating an image edge contrast based on said pixel values;

2) calculating area contrast based on said pixel values; and

3) calculating image range based on said pixel values;

C) calculating relative average lightness based on said pixel values, wherein said calculating of said relative average lightness includes calculating at least one of a first average lightness relative to an image background and a second average lightness relative to a pivot point of a tone reproduction curve; and

D) calculating said overall lightness contrast of said image by combining said relative average lightness and at least one of the following: said edge contrast, said image range, and said area contrast.

Amended Claim 8 is supported by the application as filed, notably, original Claims 8 and 12.

Claim 8 requires that calculating the relative average lightness includes calculating at least one of an average lightness relative to an image background and an average lightness relative to a pivot point of a tone reproduction curve. As stated on page 5 of the Office Action, Lee does not disclose calculating the relative average lightness. The 35 U.S.C. 102(b) rejections do not discuss relative average lightness, but on page 6, in relation to another rejection, the Office Action apparently addresses relative average lightness, citing Cutaia:

> 'This relative brightness $B_{KJ}$ is normalized by the image range (LA) to generate the relative average brightness "$B_{JK}$(normalized)" (column 10, lines 67-70).'

The cited portion of Cutaia states:

> 'The contrast criteria can also be viewed in normalized form. Thus,
>
> '$B_{KJ}$(normalized)= *number of black bits in mask area/LA.* (Cutaia, col. 10, lines 67-70)'

The definition in Cutaia contrasts with the language of Claim 8, which requires calculating an average lightness relative to an image background and/or an average lightness relative to a pivot point of a tone reproduction curve.

Claims 13-14 are allowable as depending from Claim 8.

Claims 1, 6, 7, 15, 20-22, 27, and 28 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of U.S. Patent 3,737,855 by Cutaia. The rejection stated:

> 'Regarding claims 1, 15, and 22, Lee discloses a method (figure 3) and computer program (figure 1) of determining overall lightness contrast of an image comprising:
>
> '1) extracting pixel values from said image (column 3, lines 66+: the central computer digitizes the microscope image to extract pixel values);
>
> '2) calculating an image edge contrast based on said pixel values (16, figure 3: the "edges of edges" computation is a measure of contrast at the edges);
>
> '3) calculating area contrast based on said pixel values (12, figure 3: morphological operations are used to calculate the contrast of the

entire image area, as represented by the edge gradient; furthermore, for claim 15, Lee teaches that the image can be in color, so the area contrast calculation would correspond to a color area contrast; column 3, lines 36-38); and

'B) calculating said overall lightness contrast of said image by combining: said edge contrast and said area contrast (column 5, line 61 through column 6, line 7: the image contrast score is defined as the ratio of the accumulated edges of edges intensity ("image edge contrast") and the accumulated edge intensity ("area contrast")).

'Lee does not disclose calculating image range and relative average lightness based on the pixel values, and then using the range and average lightness in calculating the overall lightness contrast.

'Cutaia discloses a character enhancement system (figure 3) that involves generating contrast measurements ("contrast measurement generators") in order to generate thresholds ("contrast threshold generators").

'In particular, Cutaia discloses computing an image range, or mask area, based on the pixel values (column 10, lines 55-57: "L" and "A" specify an image range).

'Cutaia also teaches calculating the relative brightness in the image range as "$B_{KJ}$" (column 10, line 30). This relative brightness $B_{KJ}$ is normalized by the image range (LA) to generate the relative average brightness "$B_{JK}$ (normalized)" (column 10, lines 67-70).

'Then the relative average brightness ($B_{JK}$(normalized)), which incorporates the image range (LA), is used to calculate an area contrast $S_{KJ}$ (column 10, line 34). The area contrast $S_{KJ}$ is a contrast measure that denotes the average line stroke width in the area shown in figure 7 (see column 11, lines 10-26).

'Therefore, Cutaia teaches calculating an area contrast based on an image range and a relative average lightness. The area contrast denotes the average line stroke width, which is a measure of edge intensity.

'It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lee by Cutaia achieve the

claimed invention by calculating an image range and a relative average lightness and calculating the overall lightness contrast based on those two calculations, since Lee discloses calculating edge intensity as a measure of area contrast, and Cutaia discloses that an area contrast measurement that denotes edge intensity is conventionally calculated on the basis of an image range and a relative average brightness.'

Claim 1 states:

> 1. A method of determining overall lightness contrast of an image comprising:
>
> extracting pixel values of lightness from said image;
>
> calculating an image edge contrast based on said pixel values;
>
> calculating area contrast based on said pixel values;
>
> calculating image range based on said pixel values;
>
> calculating relative average lightness based on said pixel values, and
>
> calculating said overall lightness contrast of said image by combining said edge contrast, said image range, said area contrast and said relative average lightness.

Amended Claim 1 is supported by the application as filed, notably, page 7, lines 1-12; page 8, lines 1-5; page 11, lines 10-27; page 13, lines 1-2.

Claim 1 requires that pixel values <u>of lightness</u> are extracted and those values are then used in the calculating steps. Cutaia does not measure contrast based upon lightness, but rather measures "contrast" based on numbers of black and white bits within a given area. ($B_{KJ}$ at Cutaia, col. 10 lines 46-47 (mask area); $B_{KJ}$(normalized) at Cutaia, col. 10 lines 69-70 (mask area; $S_{KJ}$ at Cutaia, col. 10 lines 48-49 (area offset from mask area)) <u>Any other lightness contrast present is not considered</u>. Cutaia states:

> "The discrete markings correspond to the division of the document to be read into elemental areas. Each of these areas is scanned to determine if it contains a predetermined minimum quantity of black markings as opposed to the absence of such markings in favor of white markings signifying the

document background. Areas containing predetermined quantities of black markings are termed black areas as opposed to white areas. The terms black area and white area are used merely to define the contrast between a mark on the document and its background. As such, the term black area defines an area containing a portion of a dark character or noise on a light background or a light character or noise on a dark background." (Cutaia, col. 3, lines 29-42; emphasis added)

"During each scan increment the intensity of the reflected beam is detected to determine if the beam has intersected a black area or a white area." (Cutaia, col. 3, lines 52-54)

On either side of a threshold, the actual lightness differences between areas are lost in the defining of "white" or "black". What Cutaia measures is not differences in contrast of an image, but rather content of a given area after removal of almost all contrast information. Claim 1 requires calculating of contrast measures based upon pixel values of lightness in the original image.

Lee is directed to measures using edges and "edges of edges". It can be argued that measures relating to edges and "edges of edges" are applicable to the black-white areas images of Cutaia, but Lee does not overcome the absence in Cutaia of measures of contrast using pixel values of lightness.

The rejection also misinterprets the term "image range" in relation to Claim 1 as an area. Image range relates to a range of lightness values of the image. (application, page 12, lines 10-13; "Image range" is correctly addressed in the rejection of Claim 4 on page 10 of the Office Action.) The range of values in an area of Cutaia after scanning is binary, white and black. Cutaia does not teach or suggest an image range as the term is used in Claim 1, because such a measure would be meaningless to Cutaia. The rejection states that Lee does not disclose calculating image range.

Claim 1 requires calculating different contrast measures of the image and an overall lightness contrast of the image. (See, for example, the previous paragraph discussing the "image range".) The rejection relies upon measures in Cutaia that do not apply to the same area. Figure 7 of Cutaia shows that $S_{KJ}$ is larger than $B_{KJ}$ (L+1 and m, rather than L and A. (Cutaia, col. 10, lines 30-35, 48-49)) and not fully inclusive of the area LA (a is offset to 1 rather than 0; see Cutaia, col. 10, lines 27-35 and Figures 3 and 7). If LA is the image in

Cutaia, then $S_{KJ}$ is not a contrast measure for the image (LA), but rather a different area that includes only part of area LA. This does not meet the language of Claim 1, nor does Lee, in combination with Cutaia change this teaching.

Claims 15 and 22 have been amended in the same manner as Claim 1 and are supported and allowable on the same basis.

The rejection stated as to Claims 6, 20, and 27:

> 'Regarding claims 6, 20, and 27, the combination of Lee and Cutaia teaches that the overall contrast is a linear combination of the image edge contrast, area contrast, image range, and relative average lightness (i.e. Cutaia's image range "LA" and relative average brightness "BJK(normalized)" are combined linearly to form the area contrast SKJ; and Lee's calculation of the overall contrast involves linearly combining the area contrast and edge contrast as a ratio).'

Claim 6 has been rewritten as an independent claim incorporating the features of Claim 1:

> 6. A method of determining overall lightness contrast of an image comprising:
>
> extracting pixel values from said image;
>
> calculating an image edge contrast based on said pixel values;
>
> calculating area contrast based on said pixel values;
>
> calculating image range based on said pixel values;
>
> calculating relative average lightness based on said pixel values, and
>
> calculating said overall lightness contrast of said image by combining said edge contrast, said image range, said area contrast and said relative average lightness;
>
> wherein said overall contrast is calculated in a linear combination of said image edge contrast, said area contrast, said image range, and said relative average lightness.

Claim 6 requires a "linear combination", which is defined by Webster's Ninth New Collegiate Dictionary as:

> **linear combination** n (1960) : a mathematical entity (as 4x + 5y +6z) which is composed of sums and differences of elements (as variables, matrices, or functions) whose coefficients are not all zero (Webster's Ninth New Collegiate Dictionary, Merriam-Webster Inc, Springfield, Massachusetts, 1990, page 694)

This dictionary definition is in accord with the application. (See page 14, lines 3-20) The rejection talks about Lee's calculation "linearly combining ... as a ratio". This would arbitrarily redefine the meaning of "linear combination". The rejection takes the same approach with Cutaia and says that LA and $B_{JK}$(normalized) being "combined linearly" to form $S_{KJ}$. The formula for $S_{KJ}$ in Cutaia is:

$$S_{KJ} = \frac{\sum_{a=+1}^{L+1} \sum_{i=0}^{m} (B_{KJ_{ia}})}{Y}$$

(Cutaia, col. 10, lines 30-35) This formula for $S_{KJ}$ is not a linear combination of LA and $B_{JK}$(normalized).

Claims 20 and 27 are allowable as depending from Claims 15 and 22, respectively, and on the same grounds as Claim 6.

Dependencies were changed for Claims 7, 21, and 28, which are supported on the same basis as Claim 6 and allowable as depending from Claims 6, 20, and 27, respectively.

Claims 2, 16, and 23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Cutaia and U.S. Patent 6,208,766 by Schweyer et al. ("Schweyer"). Claims 2, 16, and 23 are allowable on the grounds discussed above in relation to Claim 1 and as depending from Claims 1, 15, and 22, respectively. The arguments as to Claim 1 are equally applicable to the cited combination of references.

Claim 9 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of U.S. Patent 6,208,766 by Schweyer et al.

("Schweyer"). Claim 9 is allowable as depending from Claim 8 and on the grounds discussed above in relation to Claim 8. The arguments as to Claim 8 are equally applicable to the cited combination of references.

Claims 3, 17, and 24 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Cutaia and U.S. Patent 4,809,349 by Herby et al. ("Herby"). Claims 3, 17, and 24 are allowable as depending from Claims 1, 15, and 22, respectively, and on the grounds discussed above in relation to Claim 1. The arguments as to Claim 1 are equally applicable to the cited combination of references.

Claim 10 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of U.S. Patent 4,809349 by Herby et al. ("Herby"). Claim 10 is allowable as depending from Claim 8 and on the grounds discussed above in relation to Claim 8. The arguments as to Claim 8 are equally applicable to the cited combination of references.

Claims 4, 18, and 25 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Cutaia and Fundamentals of Electronic Image Processing by Weeks, Jr. ("Weeks"). Claims 4, 18, and 25 are allowable as depending from Claims 1, 15, and 22, respectively, and on the grounds discussed above in relation to Claim 1. The arguments as to Claim 1 are equally applicable to the cited combination of references.

Claim 11 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of U.S. Patent 6,208,766 by Schweyer et al. ("Schweyer"). Claim 11 is allowable as depending from Claim 8 and on the grounds discussed above in relation to Claim 8. The arguments as to Claim 8 are equally applicable to the cited combination of references.

Claims 5, 12, 19, and 26 stood objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The Office Action also stated:

> 'However, incorporation of claim 12 into claim 8 would not necessarily render claim 8 allowable, since claim 8 does not require the details of claim 12. Neither Lee nor Cutaia discloses or suggest calculating the average relative lightness by computing the first and second absolute value of a difference, as claimed.'

Claims 5, 19, and 26 have been rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 12 has been rewritten as follows:

12. A method of determining overall lightness contrast of an image comprising:

A) extracting pixel values from said image;

B) performing at least one of the following processes:

1) calculating an image edge contrast based on said pixel values;

2) calculating area contrast based on said pixel values; and

3) calculating image range based on said pixel values;

C) calculating relative average lightness based on said pixel values; and

D) calculating said overall lightness contrast of said image by combining at least two of the following: said edge contrast, said image range, said area contrast and said relative average lightness;

wherein said calculating of said relative average lightness includes calculating a first average lightness relative to an image background and calculating a second average lightness relative to a pivot point of a tone reproduction curve in a process comprising:

computing an arithmetic mean of pixel lightness values;

computing an first absolute value of a difference between a mean lightness of said image and a lightness of said image background to produce said first average lightness; and

computing a second absolute value of a difference between said mean lightness and a lightness value of said pivot point of said tone reproduction curve to produce said second average lightness.

It is believed that Claim 12, as amended, overcomes the objection.

Added Claim 29 states:

29. A method of determining overall lightness contrast of an image comprising:

extracting pixel values of lightness from said image;

calculating an image edge contrast based on said pixel values;

calculating area contrast based on said pixel values;

calculating image range based on said pixel values;

calculating relative average lightness based on said pixel values, and

calculating said overall lightness contrast of said image by combining said edge contrast, said image range, said area contrast, and said relative average lightness;

wherein said image edge contrast is calculated in a process comprising:

detecting edges in said image based on said pixel values;

determining local edge contrast at said edges; and

assessing a standard deviation around a mean value for said local edge contrast of said edges to produce said image edge contrast.

Claim 29 is supported by the application as filed, notably, original Claims 1-2 and at page 8, lines 8-15. Claim 29 is allowable on the same grounds as Claim 1 and 2 and, in addition, is allowable over the combination of Schweyer with the other references, because Claim 29 requires assessing of a standard deviation around a mean value for local edge contrast of detected edges rather than local edge contrast over an entire image.

Added Claim 30 states:

30. A method of determining overall lightness contrast of an image having a plurality of pixels, said method comprising:

calculating an image edge contrast based on values of said pixels;

calculating area contrast of said image based on values of said pixels;

calculating image range contrast based on values of said pixels;

calculating relative average lightness of said image based on values of said pixels, and

calculating said overall lightness contrast of said image, said overall lightness contrast being a linear combination of said edge contrast, said image range contrast, said area contrast, and said relative average lightness.

Claim 30 is supported by the application as filed, notably, the original claims. Claim 30 requires calculating different contrast measures of the image and an overall lightness contrast of the image and also requires that the overall lightness contrast is a linear combination. Claim 30 is allowable on the grounds discussed above in relation to Claims 1 and 6.

Added Claims 31-34 are allowable as depending from Claim 30 and as follows.

Claim 31 is supported and allowable on the same basis as Claim 29.

Claim 32 is supported by the application as filed, notably, original Claim 3.

Claim 33 is supported by the application as filed, notably, original Claim 4.

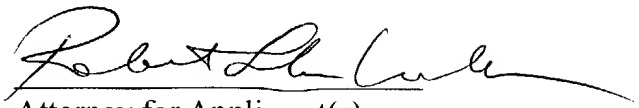
Claim 34 is supported and allowable on the grounds discussed in relation to Claim 8.

Claim 35 is supported and allowable on the same grounds as Claim 30.

It is believed that these changes now make the claims clear and definite and, if there are any problems with these changes, Applicants' attorney would appreciate a telephone call.

In view of the foregoing, it is believed none of the references, taken singly or in combination, disclose the claimed invention. Accordingly, this application is believed to be in condition for allowance, the notice of which is respectfully requested.

Respectfully submitted,



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